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THE SWEDISH NATION IN WORD AND PICTURE
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PLANT BREEDING IN SWEDEN

BY

DR. HANS TEDIN
SVALÖF

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STOCKHOLM - SWEDEN
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PLANT BREEDING IN SWEDEN

BY

Dr. HANS TEDIN

SVALÖF

THE PRACTICAL PLANT BREEDING IN SWEDEN IS AS TO origin and development intimately associated with the name of Svalöf, a village, situated in Skåne, the southermost province of Sweden, about four Swedish miles from Malmö. On the initiative of BIRGER WELINDER in Svalöf, »The South Swedish Association for the cultivation and improvement of seeds» was established in 1886. The idea won lively adherence so that two years later the Association was enlarged and included the whole country. In 1889 a like association was organized for Middle Sweden, but after five years only, the two associations were united to one organization now officially called the *Swedish Seed Association.* From an inconsiderable origin the Association has, little by little, attained a great development. It has, as will be shown in the following, been of extraordinarily great importance for the improvement of Swedish agriculture and the increase of its production. Svalöf sorts have been proved on trial on both a large and a small scale all over the world, wherever a rational growing of the common cereals, wheat, rye, barley and oats is carried on. In several European countries, and not only in the countries nearest Sweden certain sorts have been greatly spread.

From north to south, Sweden extends over 14 degrees of latitude. The climate and soil in different parts are therefore very different, and the general conditions for agriculture show considerable variations also. In order to look to the need of different provinces as to better sorts, more suited to their locality and with a higher yield, branch stations were established in different parts of the country. There are now eight such stations, the northermost being situated somewhat north of the 65th degree of latitude, near the town Piteå. The chief aim of these stations is to find out through systematic and comparative field trials, which sorts are best suited to the different provinces, and also to carry on local plant breeding, if such is necessary for the production of still better sorts in the different parts of the country.

A proof of the interest, which the Association and its work aroused from the very first, are the contributions, which have been given both from private men and from the public. Of the 26 Provincial Agricultural Societies of Sweden one after another began to help the Association, so that in 1890 all of them contributed with large or small sums to the support of its work. From the government, which during the first years only gave temporary subsidies, the Association has now, since the year 1891, received an annual and from time to time increased supply. The contributions from the Provincial Agricultural Societies were discontinued in 1914, but then compensation was given by the government. The supply, which the government last year granted the Association and its branch stations for 1921, was in all 185,600 crowns.

The first director of the Association was TH. VON NEERGAARD, a mathematician and chemist from Holstein. He, however, kept the leadership till 1890 only, when he was succeeded by professor N. HJALMAR NILSSON, who is still director. In connection with the growth of the Association and its work the staff of trained botanists has also been increased. There are now 11 specialists at the main station and eight superintendents of the branch stations as well, and several extra or temporary assistants.

At first and for a rather long time the plant breeding was limited to wheat, oats, barley, peas and vetches. As time passed all other agricultural plants grown in Sweden were subjected to this improvement: rye 1900, forage plants and potatoes 1905, field roots 1914, flax and rape 1918. Certain crops were alotted to different experts, belonging to the Association, and each one, as director of a section or assistant is to lead the work and is responsible for the crops or the group of crops alotted to him. The improvement of wheat and oats was lead by prof. HJ. NILSSON till 1900. His work was then continued by NILSSON-EHLE till 1915, when it was handed over to Dr. ÅKE ÅKERMAN. The agronome PEHR BOLIN had the barleys till 1900, when the responsibility therefore was taken by the author, who since 1892 has been entrusted with the improvement of peas and vetches. Agronome E. W. LJUNG, the secretary of the Association, is responsible for rye, Mr. JOH. FR. LUNDBERG for potatoes, prof. NILSSON and Agronome GUSTAV SUNDELIN for field roots, and Dr. NILS SYLVÉN for flax and rape. Dr. HERNFRID WITTE, who hitherto was head of the section for forage plants, has this year become director of the Swedish Moor Culture Association and a new leader has not as yet been appointed.

At first the »*methodical system of mass selection*», a system at that time commonly followed all over Europe, was adopted. The aim thereof was, by selection year from year, to change a sort in a certain desired direction. It was also at that time believed, that correlations between different factors were common and it was thought, that in these one could find guidance for the selection. It was thought that a compact head went with stiff straw and that from the different types of the panicles of oats conclusions could be drawn as to their yielding power. The above mentioned are only a couple of the supposed correlations, which were thought to be very important for the selection and breeding of plants. In order to simplify the measuring and weighing of heads, kernels etc., used as a basis for the selection, some mechanical instruments were devised, such as the automatic classificator, to determine the density of the heads, the automatic weighing machine, for the sorting of heads according to their weight and a riddling-machine, for the controlling of the size of the kernels etc. All these, however, are now, since many years, only of historical interest.

From the results of the works of the first years, several valuable selections were made of those sorts of barley and oats, which were subjected to comparative field trials and were then found to be mostly worth cultivating (Probsteier Oats, Chevalier Barley, Plumage Barley, Printice Barley etc.). As products of this »mass selection» may also be mentioned the sorts, which at the same time, 1895, were put forth on the market: Borstlös Propsteierhavre (Awnless Probsteier Oats), and Renodlad Squareheadvete (Seelcted Squarehead Wheat). The latter was gained by repeated selections of an English Squarehead wheat, imported about 1880, and which after severe winters was at last acclimated. By these repeated selections the variety gained great uniformity and also remarkable winter-hardiness without loosing its Squarehead type. While the imported Squarehead — and as is yet the case with this imported variety — was not even winter-hardy enough for the most southern province of the country and consequently did not give a greater average yield than the old, unimproved, native »land wheat», the Selected Squarehead greatly surpassed this latter sort not only in Skåne but also at a branch station at Ultuna in Middle Sweden.

Professor Hj. Nilsson, who when he assumed the leadership as director of the Association, was Lecturer of Botany at the University of Lund, had, when he attended the University, studied systematic botany and had made himself known as a distinguished florist. It was therefore quite natural that since he came to Svalöf greater attention was paid to the botanical and morphological characters of the different parts of the plants, and the differences in these, by which they are distinguished from one another. A closer examination of the morphological differences and the observations, which then were made as to the constancy of the progeny, depending upon whether it came from one or several plants, lead up to the *System of Pedigree*, 1892. It was found that almost as regularly as the progeny which came from a single plant was constant, just as often was the progeny, coming from several plants, mixed and ununiform, even if these plants were alike in appearance.

The System of Pedigree was certainly no new system, it having already been used for several decades by other investigators and plant breeders. Peculiar for Svalöf, however, was the consistency and extension with which it was immediately adopted. The first direct result of this application was the discovering of the great multiplicity of forms, which is typical for the old »land sorts» of cereals. Already during the first years after the system had been adopted a very great number of hereditarily (genotypically) different forms were separated from old native and foreign sorts of all the crops, with which the work was carried on — from common vetch *(Vicia sativa)* for instance several hundreds were gained.

From deviations in the density of the heads of wheat and the characters of the panicles of oats, from certain characters of the kernels of barley, the colour of the blossoms and seeds in peas and vetches etc. systems were devised by which the great multitude of types was arranged into different groups. And even if these systems were more artificial than natural and even if they were of no great use for the breeding work, still they to a great degree facilitated the handling of the varieties and the forms. In order to gain such a desirable facility, genealogical tables of the plants were also devised and exact stock books with notes about the appearance of the different types in the field and about their chief characters were kept. The keeping of stock books, however, was soon given up. It was considered unnecessary, as the details about the types, which were registered in them, were to be found almost as easily in the »field books», which were annually kept and which are still kept about all the plots, cultivated during the year, and in these books notes are made about all the types. Genealogical tables are still made. A complete list of ancestors is always useful for instance in order to get a summary of the numerous progenies of different generations of crossings.

As has already been remarked, the separated forms were from the beginning constant. The crops before mentioned, wheat, oats, barley, peas and vetches, which at the time of the adoption of the pedigree system had already been investigated, are typical self-fertilizers and the pedigree sorts are therefore pure lines. That this constancy was perfectly permanent was not clear from the beginning. Hoping that they could still be improved, the pedigree sorts of the above mentioned crops were also subjected to a repeated selection which, however, naturally was without result.

In oats and still more in wheat and seemingly also in vetches spontaneous crossings occasionally take place. This is also the case with common six-rowed barley *(Hordeum tetrastichum)*. Even spontaneous variations (mutations) can arise. According to NILSSON-EHLE, for instance, who first observed the fact, wild-oat types often, if not regularly, arise as a result of »loss-mutation» in originally constant pedigree sorts of white oats. And when an originally constant pedigree sort thus for one reason or other becomes ununiform it is naturally necessary to make a new selection in order to regain the original form.

The constancy of the types warrants that the advances which they represent will be permanent. Thanks to this fact it will also be possible to form a far more accurate opinion as to what conditions the different sorts require, than when dealing with mixed sorts. These sorts can namely be changed hereditarily by external circumstances. According as the agricultural conditions change, now one and now another of the mixed parts is favoured and increases in quantity at the cost of other parts. Thanks to their constancy and uniformity the pedigree sorts are also easier to recognize and consequently give greater possibilities for an effective control, a fact which is a necessary condition in order to carry on a real and an honest trade with improved sorts. Nothing is gained by getting an improved sort which can not be recognized but is easily mistaken for less valuable sorts. Both difficult and expensive measures would at least have to be taken in this case in order to prevent the latter being launched on the market under false flag.

It must, as is easily understood, take several years before the first pedigree sorts were ready for sale, but thereafter these were rapidly followed by like sorts, a proof of the value of this method for plant breeding. Many of these sorts, raised by line selection from old sorts are no longer cultivated, they having been superseded by still better sorts, but many of them are still cultivated and successfully compete with the best sorts, produced during the last years.

Thus it has been observed that the Segerhavre (Victory Oat, 1908) as well as the Guldregnshavre (Golden Rain Oat, 1903), both white oat sorts and both descending from the Milton Oat, a mixed sort of the Probsteier type, which is said to come from America, have been difficult to surpass. (The numbers mentioned in the parenthesis, both here and in the following, name the year, when each sort was put forth on the market.) Of black oat sorts the Stormogulhavre (Great Mogul Oat, 1901) still gives the highest yield. This type as well as the Klockhavre (Bell Oat, 1901) is bred from the Black Tartarian Plume Oat. On account of its late maturity the Great Mogul Oat has not, however, gained that importance within the black oat districts, which are situated in Middle Sweden especially, which it otherwise would have done.

Characteristical for the black oat sorts is the fact that their straw developes relatively late but in return they stool much more luxuriantly, qualities which make them especially suitable for the stiff clay soils of Middle Sweden and which at the same time give them a greater power of resistance against the Frit Fly *(Oscinis Frit)*, which otherwise can do much damage, especially if the sowing has been late. Dr. Åkerman hopes to be able by crossing to make the most of this quality in the black oat sorts when continuing the improvement of white oats.

Of barley sorts the Prinsesskorn (Princess Barley, 1897), taken from Prentice Barley, a sort, which originally came from England, and the Gullkorn (Golden Barley, 1913), out of an old native land barley from the Island of Gotland are still most generally grown in South and Middle Sweden. Besides these, both Chevalier II (1900), taken from Horsfords Crossbred Chevalier from America, as well as Svanhalskorn (Swan-neck Barley, 1899) and Primuskorn (Primus Barley, 1901) are still considered as the most suitable under growing conditions more particularly suited to them.

The sorts of peas and vetches, which during the years 1900—1907 were put forth from Svalöf have only just lately begun to get competitors. These were in number 4 respectively 2 and all improved by line selection from foreign mixed sorts. The Svalöf sorts of peas have by their considerably higher average yield (the increase is 20 to 30 to 40 %) made the cultivation of peas much more profitable than hitherto.

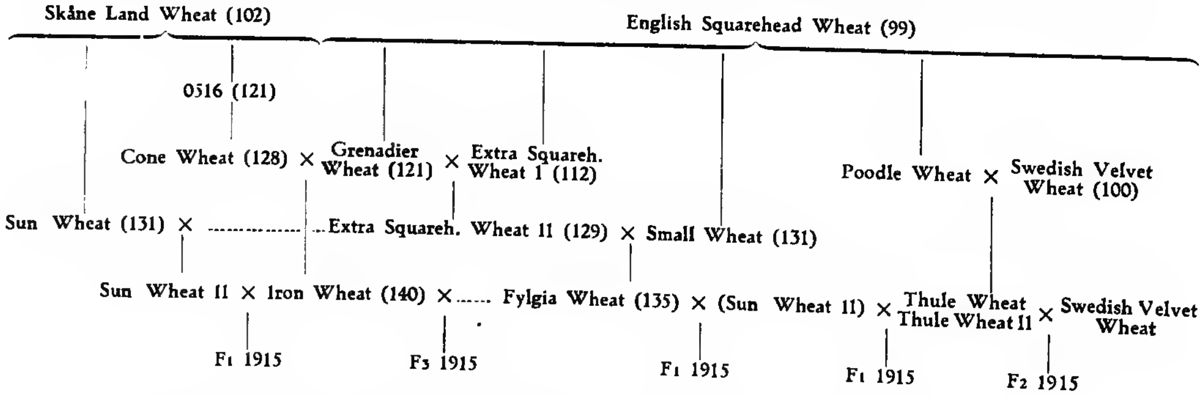
The renewal of sorts of winter wheat has been the greatest, for the cultivation of all those pedigree sorts which were put forth first has been given up, these being surpassed by new sorts with a still higher yield. These sorts at that time however marked a great progress. The English Squarehead wheat produces under favourable conditions and with sufficiently mild winters 50 % higher yield than the Swedish land wheat. But, by reason of its lack of winter-hardiness the average yield of the former sort was even in the most southern parts of the country scarcely superior to that of the latter sort. Thanks to a greater winter-hardiness Svalöfs Extra Squarehead Wheat (1900), taken by line selection from imported Squarehead, gave an increase of the average yield with about 12 %. And the increase for Grenadier Wheat, a pedigree sort, taken from a Squarehead sort, imported from Scotland about 1880, was not less than 20 %, despite a winter-hardiness somewhat lower than that of Extra Squarehead. But Grenadier Wheat has hardly been surpassed by any hitherto tested sort, when speaking of its specific yielding power, by which is simply meant the yielding power of a sort when this power is not lessened by too severe winters or by other temporary causes. A chief quality of Grenadier is also its unusually stiff straw. For those districts in Middle Sweden, which are more favourably lotted for wheat growing, the Borevete (Bore Wheat, 1902) and the Pudelvete (Poodle Wheat, 1910), both pedigrees taken from a sort imported from Holstein by Neergaard had an increase of about 10 % of the average yield, when compared to native land wheat.

These sorts have now almost entirely disappeared. When improving winter wheat by crossing, these sorts, however, have been of great use as will soon be observed.

Crosses of both barley and peas were made to a great extent already about 1890 and also of winter wheat later on during the same decennium. All these crosses, however, were made without any special object, although perhaps in some cases with the hope of getting a practically useful result from some of them. Crossing was at that time generally considered as a way of stimulating or producing a variation. It was not until after the discovery of the Mendelian laws of segregation that artificial cross-fertilization became used systematically with a definite purpose and to a great extent. The honour of having applied these laws in the practical breeding work is due to Nilsson-Ehle, who at once understood the value of this discovery when improving both oats and winter wheat especially. It is easy to understand that the winter wheat in this case was especially easy to work with. It now became the chief aim of the workers to combine the high yield of Squarehead wheat with the hardiness of the old native land sorts to a greater extent than they had hitherto been able to do by line selection. When improving barley and oats, on the contrary, there have been no such decisive characters of yield to work with. There have been no foreign sorts of barley and oats either, which have been as superior to the old Swedish sorts as Squarehead to old Swedish land wheat. At the beginning nobody hoped, not even Nilsson-Ehle himself, that the yielding power of the former and the hardiness of the latter could be combined to so great an extent as has now been done by him.

The purpose of crossing sorts with characters of different degrees of value, for practical use, is to produce new combinations of characters which from a practical point of view are still more valuable. Cross-breeding is a combination-breeding. The way of working and the results already gained are clearly shown in the following scheme, borrowed from Nilsson-Ehle. The numbers in parenthesis give the average yield of the trials made at the Association at Svalöf. These are expressed in relative numbers compared with Svenskt Sammetsvete (Swedish Velvet Wheat) = 100. One of the sorts has no name and is therefore called by its stock book number 0516; a stock book number is in reality a substitution for a name and is used in all tables, genealogical schemes, field books etc. were the sorts are mentioned.

SUMMARY OF PART OF THE CONTINUED COMBINATION WORK WITH WINTER WHEAT AT SVALÖF.


Skåne Land Wheat (102)
English Squarehead Wheat (99)
0516 (121)
Cone Wheat (128) × Grenadier Wheat (121) × Extra Squareh. Wheat I (112)
Poodle Wheat × Swedish Velvet Wheat (100)
Sun Wheat (131) × ....Extra Squareh. Wheat II (129) × Small Wheat (131)
Sun Wheat II × Iron Wheat (140) ×...... Fylgia Wheat (135) × (Sun Wheat II) × Thule Wheat Thule Wheat II × Swedish Velvet Wheat
F1 1915
F3 1915
F1 1915
F1 1915
F2 1915

To describe the different characters of the crossed sorts more closely and the purpose of each cross would take too long time. Iron Wheat, for instance, has inherited good winter-hardiness and a high degree of resistance against yellow rust from Kottevete (Cone Wheat), a sort which very likely is a product of a spontaneous crossing between land wheat and Squarehead wheat, and from Grenadier Wheat high specific yielding power, stiff straw, relatively early maturity and relatively good kernel quality. In the same way Fylgia Wheat has inherited high yielding power, relatively good resistance against yellow rust and relatively early maturity from Smaahvede (Small Wheat), a Danish improved sort, and from Extra Squarehead II relatively good winter-hardiness and relatively early maturity. Both are intended for southern Sweden and Iron Wheat for Skåne especially. The importance of its high yield can easily be understood when one hears that about half of the wheat, produced in Sweden, comes from this province. None of the sorts mentioned in the summary, however, have all qualities to the highest degree and therefore the workers hope, by continued crosses to be able to produce still better combinations. Besides with the sorts mentioned at the bottom of the summary, Dr. ÅKERMAN is now also working with crosses, which he himself has made.

Systematic crossing has also been sucessfully used when improving other self-fertilizing crops and has given rise to several valuable sorts even if it has not been able, from above mentioned reasons, to show such fine results as with winter wheat.

I will be brief when speaking about the other plants, rye, field roots and forage plants etc., mentioned in the beginning. To force typical cross-fertilizers to self-fertilization, year after year, can by degrees result in a weakening of the progeny. This seems for instance often to be the case with timothy, according to WITTE who has also shown a greatly different power of self-fertilization in different strains of this grass. They vary from almost self-sterile strains to such with a very high degree of self-fertilization. HERIBERT-NILSSON at the plant breeding institution of Weibullsholm, about which more will be mentioned later on, has found the same fact to be true with rye.

The pedigree method, however, is also used when improving cross-fertilizers, but naturally with necessary care and combined with mass selection. When improving these crops systematic crossing is also used. The methods of the work must of course vary in each case according to the plant and the chief object of the breeding. In order to avoid spontaneous undesired cross-fertilization different isolating methods are used.

The work with the plants in question has also made considerable progress. Three sorts of rye have hitherto become of practical use, two especially for southern and one for middle Sweden, and all superior to the sorts before cultivated. Rye is, in view of the extension of the cultivated areal, next to oats the most important cereal in Sweden and for bread uncomparably more important than wheat. The former occupies about 3½ times as large an areal as the latter. It is easy to understand what an increase of the yield of rye per hektare would mean for the nourishment of the people.

Even of several of the chief grasses have been produced strains, improved in different respects, with higher yielding power than those hitherto cultivated and guaranteeing a more even and a more uniform development of the mixed plants of the artificial meadows, a necessary condition for a good quality of the hay.

Even several new sorts of potatoes have during the last years been put forth. No new sorts of flax and rape can as yet be ready, but they are being successfully investigated. Svalöf sorts of different kinds of field roots (mangels, Swedes, turnips and carrots) cannot be said to be superior to all other sorts but they stand on a level with the best ones. To be able to keep them on this high level, so that they do not decline, requires continuous attention and constantly repeated selections founded on a careful investigation of the chief characters of the mother plant and of the progeny. Professor Hjalmar Nilsson has also during the last years begun to work with mangels with the purpose of producing sorts comparable in uniformity and constancy with those of self-fertilizers. This he intends to achieve by a more strictly conducted pedigree selection and an artificial crossing of sister individuals most like each other.

As a contributive cause of the high average yield of Iron Wheat is also mentioned a high degree of resistance against yellow rust, a disease which some years appears and ravages such sorts as are less resistant. Besides yellow rust a large number of other dangerous plant diseases are already known, even such as are caused by animal parasites, towards which different sorts of the same crop behave very differently, a fact which has also been considered in the breeding work. The producing of sorts resistant against diseases will surely be an effective remedy against these plant diseases and thus a way of increasing the production. Another important problem, upon the solution of which work has already been begun, is the improvement of the kernel quality, especially in wheat in order to produce sorts better suited for bread-baking — without mentioning all other future objects of improvement.

The field trials are an important part of the improvement work. They are the beginning and end of all breeding, for without good trial plots one works as a blindman and the whole improvement work floats in the air without the firm basis which they form. It is namely only by comparative trials that the eventual superiority of a new sort to already cultivated ones can with certainty be determined. But one thing is certain, the better the sorts get the less progress can be expected. The trials, however, must also be more exact and more free from errors in order to be able to determine accurately the differences that possibly exist between the sorts. The improvement of the trial system, so that the trials become as reliable as possible, is one of the most important objects of the plant breeding. In Svalöf the principle generally followed from the beginning has been to give the sorts in the trial-plots no better conditions than they get in the general cultivation, apparantly a quite correct principle, the strict accomplishment of which has been of great benefit for the work.

The *General Swedish Seed Company* was founded 1891 along side of the Swedish Seed Association, with the purpose of distributing the new sorts to the farmers. It is exclusively a commercial company, with its main office at Svalöf. The Company, which alone has the right, receives the improved sorts from the Association according to certain rules, sanctioned by the Government. They cultivate them first on their own farms, which together cover a field area of about 1,500 hektares, and also by contracts on fields belonging to farmers all over the country. Last year these cultures on fields belonging to private farmers together covered an area of 6,000 hektares. All cultures are inspected while growing by the specialists of the Association. The entire seed business of the Company, thus the business with imported foreign seeds also, is under the strict control of the Control Office of the Association of which Mr. J. N. Walldén has been superintendent from the beginning. All deliveries sent out by the Company, from the largest to the smallest, are delivered under the seal of the Association, and with a guarantee as to purity, germinating power etc. The number of sealed sacks delivered last year was about 133,000, and all the seed delivered amounted to about 8,200 tons. The annual export of elit and original seed of Svalöf sorts amount to about 1,000 tons. Last year the Company paid the Association 117,500 crowns in compensation. The work of the General Seed Company, controlled by the Seed Association, has greatly helped to bring the seed business to the relatively high position which it now holds in Sweden.

The affairs of the Company and the Association are administered by different councils. One member of the council of the Company and five belonging to that of the Association (7 in all) are chosen by the Government in order to be able to control the work of both and to excercise influence as to the use of the state subsidies. The Association is also under the control of the Royal Board of Agriculture, which is subordinate to the Agricultural Department and is the highest administrative authority for agriculture.

As well as at the Swedish Seed Association, plant breeding is also carried on to a great extent and according to quite modern principles and methods at *Weibullsholm*, a plant breeding institution near Landscrona, a town situated a couple of Swedish miles from Svalöf. The work there began about fifty years ago. The father of the present owner began about 1870 to cultivate and sell seed from field roots as a by-trade. He soon began to try to improve these also, first by mass selection of roots, according to their form, but later on with guidance of their specific weight, gained by sinking them into a salt-solution of a certain concentration. About 1890, when the eldest son had begun to devote himself to the improvement work, new principles were introduced, which were of decisive importance for the future development of Weibullsholm. The pedigree method began to be adopted 1898. The first scientist, Dr. Birger Kajanus, was engaged 1907. The improvement work is now carried on by four sections, each of them with a scientific botanist as leader of the breeding work, assisted by an agronome as leader of the practical trials. Kajanus has devoted his attention to winter wheat, six-rowed barley, peas, vetches and forage plants. Dr. Nils Heribert-Nilsson, Lecturer of Genetics, is responsible for rye, oats and potatoes, Dr. Carl Hallquist has field roots and two-rowed barley as his speciality and Amanuensis Carl Hammarlund has charge of the vegetables. The latter is also head of the Control Office of the Institution. An extensive seed business is namely combined with the improvement work. The leader of the whole firm is Harry Weibull, while three of his brothers are responsible for a department each.

Since many years the firm has naturally dealt with its own improved sorts and strains of all different kinds of field roots and their present sorts compete with the best ones from Svalöf. As results of the improvement work it has also put forth on the market two winter wheat sorts, two rye sorts, one oat sort, two pea sorts, and also strains of the most important forage grasses. It has also its own sorts of vegetables as well.

One of the wheat sorts, Standard Wheat, which will be put forth this autumn and which is intended for the southermost provinces is produced by artificial crossing between Iduna Wheat, from Weibullsholm about ten years older, and a Danish sort. Storm Rye, characterized by its relatively short and stiff straw which makes it easier to cut with self-binding harvest-machines is produced from a German sort, Petkuser Rye, by repeated selections four years in succession, the first two years by line selection, the last two years by mass selection, by removing before the plants bloomed, all such as had straw higher than the average height. In specific yielding power, however, the Storm Rye is somewhat inferior to the mother sort. A new sort, Storm Rye II, with short straw as the first Storm Rye, but according to Heribert-Nilsson with a specific yielding power equal to Petkuser Rye has been produced by sowing like portions of Storm Rye and another pedigree with short straw together and letting them fertilize naturally.

The farms belonging to the firm occupy together an area of about 1,800 hektares, but it also has cultures by contracts with private farmers.

In view of the extension of the work and the knowledge of the object with which the work is carried on it will undoubtedly be of great importance for the Swedish agriculture. By its field root cultures, field root seed cultures and field root improvement the firm has been of a very great importance for the development of the Swedish field root growing.

In the year of 1906 *the Swedish Sugar Manuf. Company* began with seed culture and improvement of sugar mangels with the purpose of making all import of sugar mangel seed unnecessary. This work, which is lead by Dr. Hans Rasmusson has given the desired results. Thus the crop of sugar mangel seeds produced last year is adequate to the need of such seeds in Sweden. The sugar mangels grown from these native seeds can readily be compared with the best imported sorts and are in several cases even superior to these, this owing to the improvement work consequently carried on.

Finally, since some years a rather extensive breeding of vegetables is carried on partly at *the horticultural division of the Agricultural College at Alnarp*, situated about 1/2 a Swedish mile from Malmö, the work being lead by Mr. J. Rasmusson, and partly at one of the farms near Malmö, belonging to *the General Swedish Seed Company* at Svalöf, the work being lead by Professor H. Nilsson-Ehle and Dr. K. Kristoffersson. The improvement work has not as yet been carried on long enough to be able to influence the cultivation of vegetables in Sweden, but new improved sorts of different plants are now ready. And there is no doubt that the work will contribute to the improvement of this cultivation by providing better and more profitable material for it.